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09/665,911	09/20/2000	Yasuhiko Nomura	001221	5447

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EXAMINER
LANDAU, MATTHEW C

ART UNIT	PAPER NUMBER
2815	

DATE MAILED: 06/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/665,911	NOMURA ET AL.	
	Examiner	Art Unit	
	Matthew Landau	2815	

-- The MAILING DATE of this communication appears on the cover she t with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-19* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-19* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *20 September 0200* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

2. Claims 1 and 9 are rejected under 35 U.S.C. 102(e) as being anticipated by Kawai.

In regards to claim 1, Figure 8 of Kawai discloses a semiconductor light emitting device comprising: an active layer (25,26,27) composed of a nitride based semiconductor (GaN); a cladding layer 28 composed of a nitride based semiconductor of a first conductivity type, and having a flat portion and a ridge portion formed on the flat portion; and a first current blocking layer 31 formed on said flat portion and on sidewalls of said ridge portion of said cladding layer and composed of a high-resistive nitride based semiconductor containing impurities (see column 8, lines 5-9).

In regards to claim 9, Kawai discloses the nitride based semiconductor contains gallium (see column 7, lines 29-33).

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kawai in view of Okazaki et al. (US Pat. 5,966,396), hereinafter referred to as Okazaki.

The difference between Kawai and the claimed invention is the impurities containing at least one of zinc, beryllium, calcium, and carbon. Okazaki discloses doping the current blocking layer with zinc (see column 5, lines 60-61). It would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kawai by using zinc as the impurity ion. The ordinary artisan would have been motivated to modify Kawai in the manner described above for at least the purpose of selecting an impurity ion with similar resistive properties.

5. Claims 3, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawai in view of Johnston, Jr. et al (US Pat. 4,888,624) hereinafter referred to as Johnston.

In regards to claim 3, the difference between Kawai and the claimed invention is the first current blocking layer with a resistance value of not less than 1.5 Ω-cm. Johnston discloses a current blocking layer 20 having a resistivity of at least 1×10^6 Ω-cm (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kawai to include a current blocking layer with a resistivity value greater than 1.5 Ω-cm. The ordinary artisan would have been motivated to modify Kawai in the manner described above for at least the purpose of increasing the effectiveness of the current blocking layer.

In regards to claim 5, the difference between Kawai and the claimed invention is the first current blocking having a thickness not less than 0.5 μm. Johnston discloses a current blocking layer 20 between 1 and 4 μm thick (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kawai to increase the thickness of the current blocking layer to a value greater than 0.5 μm. The ordinary artisan would have been motivated to modify Kawai in the manner described above for the purpose of increasing the effectiveness of the current blocking layer.

In regards to claim 6, the difference between Kawai and the claimed invention is the first current blocking having a thickness not less than 1.0 μm. Johnston discloses a current blocking layer 20 between 1 and 4 μm thick (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kawai to increase the thickness of the current blocking layer to a value greater than 1.0 μm. The ordinary artisan would have been motivated to modify Kawai in the manner described above for the purpose of increasing the effectiveness of the current blocking layer.

6. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kawai in view of Adachi et al.

The difference between Kawai and the claimed invention is a second current blocking layer formed on said first current blocking layer and composed of a nitride based semiconductor of a second conductivity type opposite to said first conductivity type. Figure 3 of Adachi et al. discloses a p-type cladding layer 5, a first current blocking layer 7, and an n-type second current blocking layer 8. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kawai by forming a second current blocking layer of a second conductivity type on the first current blocking layer. The ordinary artisan would have been motivated to modify Kawai in the manner described above for the purpose of lowering the light confining effect while maintaining the carrier confining effect (see column 12, lines 50-55).

7. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kawai in view of Hiroyama et al.

In regards to claim 7, the difference between Kawai and the claimed invention is the flat portion of the cladding layer having a thickness not more than 0.3 μm. Figure 1 of Hiroyama et al. discloses a cladding layer 7 with a flat portion 7a and a ridge portion 7b, whereby the thickness t of flat portion 7a is selected to be not greater 0.08 μm (see column 10, lines 22-27). In view of such teachings, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kawai by decreasing the thickness of the flat

portion to a value not more than 0.3 μm. The ordinary artisan would have been motivated to modify Kawai in the manner described above for the purpose of increasing the real refractive index difference of the active layer between the region under the ridge portion and the region under the flat portion.

In regards to claim 8, the difference between Kawai and the claimed invention is the flat portion of the cladding layer having a thickness not more than 0.08 μm. Figure 1 of Hiroyama et al. discloses a cladding layer 7 with a flat portion 7a and a ridge portion 7b, whereby the thickness t of flat portion 7a is selected to be not greater 0.08 μm (see column 10, lines 22-27). In view of such teachings, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Kawai by decreasing the thickness of the flat portion to a value not more than 0.08 μm. The ordinary artisan would have been motivated to modify Kawai in the manner described above for the purpose of increasing the real refractive index difference of the active layer between the region under the ridge portion and the region under the flat portion.

8. Claims 1, 2, 9, 10, 11, 12, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Okazaki.

In regards to claim 1, Figure 2A of Hirata discloses a semiconductor light emitting device comprising: an active layer 3; a cladding layer 4 of a first conductivity type formed on said active layer, and having a flat portion and a ridge portion 4a formed on the flat portion; and a first current blocking layer 8 formed on said flat portion and on sidewalls of said ridge portion 4a of said cladding layer 4. The difference between Hirata and the claimed invention is the active

layer, cladding layer, and current blocking layer composed of nitride based semiconductors. Figure 10 of Okazaki discloses a light emitting device comprising an active layer 306, cladding layer 304, and current blocking layer 310, each composed of a nitride based semiconductor. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Hirata by using a nitride based semiconductor layers. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of fabricating a short-wavelength light emitting diode.
A further difference between Hirata and the claimed invention is the current blocking layer containing impurities. Okazaki discloses the current blocking layer doped with Zn (see column 5, lines 60-61). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by doping the current blocking layer with an impurity ion. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the resistance of the current blocking layer.

In regards to claim 2, a further difference between Hirata and the claimed invention is the impurities containing at least one of zinc, beryllium, calcium, and carbon. Okazaki discloses doping the current blocking layer with zinc (see column 5, lines 60-61). It would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by using zinc as the impurity ion. The ordinary artisan would have been motivated to modify Hirata in the manner described above for at least the purpose of selecting an effective impurity ion that is well know and commonly used in the art.

In regards to claim 9, Okazaki discloses the nitride based semiconductor contains gallium.

In regards to claim 10, Figure 2A of Hirata discloses a semiconductor light emitting device comprising: an active layer 3; a cladding layer 4 of a first conductivity type formed on said active layer, and having a flat portion and a ridge portion 4a formed on the flat portion, said cladding layer 4 having a recess 4b on said flat portion along both sidewall of said ridge portion 4a; and a first current blocking layer 8 formed on said flat portion and on sidewalls of said ridge portion 4a such that it is embedded in said recess of said cladding layer 4. The difference between Hirata and the claimed invention is the active layer, cladding layer, and current blocking layer composed of nitride based semiconductors. Figure 10 of Okazaki discloses a light emitting device comprising an active layer 306, cladding layer 304, and current blocking layer 310, each composed of a nitride based semiconductor. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to modify the invention of Hirata by using a nitride based semiconductor layers. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of fabricating a short-wavelength light emitting diode.

In regards to claim 11, a further difference between Hirata and the claimed invention is the current blocking layer containing impurities. Okazaki discloses the current blocking layer doped with Zn (see column 5, lines 60-61). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by doping the current blocking layer with an impurity ion. The ordinary

artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the resistance of the current blocking layer.

In regards to claim 12, a further difference between Hirata and the claimed invention is the impurities containing at least one of zinc, beryllium, calcium, and carbon. Okazaki discloses doping the current blocking layer with zinc (see column 5, lines 60-61). It would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by using zinc as the impurity ion. The ordinary artisan would have been motivated to further modify Hirata in the manner described above for at least the purpose of selecting an effective impurity ion that is well know and commonly used in the art.

In regards to claim 19, Okazaki discloses the nitride based semiconductor contains gallium.

9. Claims 3, 5, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Okazaki as applied to claim1 above, and further in view of Johnston.

In regards to claim 3, a further difference between Hirata and the claimed invention is the first current blocking layer with a resistance value of not less than 1.5 Ω-cm. Johnston discloses a current blocking layer 20 having a resistivity of at least 1×10^6 Ω-cm (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata to include a current blocking layer with a resistivity value greater than 1.5 Ω-cm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for at least the purpose of increasing the effectiveness of the current blocking layer.

In regards to claim 5, a further difference between Hirata and the claimed invention is the first current blocking having a thickness not less than 0.5 μm. Johnston discloses a current blocking layer 20 between 1 and 4 μm thick (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata to increase the thickness of the current blocking layer to a value greater than 0.5 μm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the effectiveness of the current blocking layer.

In regards to claim 6, a further difference between Hirata and the claimed invention is the first current blocking having a thickness not less than 1.0 μm. Johnston discloses a current blocking layer 20 between 1 and 4 μm thick (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata to increase the thickness of the current blocking layer to a value greater than 1.0 μm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the effectiveness of the current blocking layer.

10. Claim 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Okazaki as applied to claim 1 above, and further in view of Adachi.

A further difference between Hirata and the claimed invention is a second current blocking layer formed on said first current blocking layer and composed of a nitride based semiconductor of a second conductivity type opposite to said first conductivity type. Figure 3 of

Adachi et al. discloses a p-type cladding layer 5, a first current blocking layer 7, and an n-type second current blocking layer 8. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by forming a second current blocking layer of a second conductivity type on the first current blocking layer. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of lowering the light confining effect while maintaining the carrier confining effect (see column 12, lines 50-55).

11. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Okazaki as applied to claim 1 above, and further in view of Hiroyama et al.

In regards to claim 7, a further difference between Hirata and the claimed invention is the flat portion of the cladding layer having a thickness not more than 0.3 μm. Figure 1 of Hiroyama et al. discloses a cladding layer 7 with a flat portion 7a and a ridge portion 7b, whereby the thickness t of flat portion 7a is selected to be not greater 0.08 μm (see column 10, lines 22-27). In view of such teachings, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by decreasing the thickness of the flat portion to a value not more than 0.3 μm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the real refractive index difference of the active layer between the region under the ridge portion and the region under the flat portion.

In regards to claim 8, a further difference between Hirata and the claimed invention is the flat portion of the cladding layer having a thickness not more than 0.08 μm. Figure 1 of

Hiroyama et al. discloses a cladding layer 7 with a flat portion 7a and a ridge portion 7b, whereby the thickness t of flat portion 7a is selected to be not greater 0.08 μm (see column 10, lines 22-27). In view of such teachings, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by decreasing the thickness of the flat portion to a value not more than 0.08 μm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the real refractive index difference of the active layer between the region under the ridge portion and the region under the flat portion.

12. Claims 13, 15, and 16 rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Okazaki as applied to claim 10 above, and further in view of Johnston.

In regards to claim 13, a further difference between Hirata and the claimed invention is the first current blocking layer with a resistance value of not less than 1.5 Ω-cm. Johnston discloses a current blocking layer 20 having a resistivity of at least 1×10^6 Ω-cm (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata to include a current blocking layer with a resistivity value greater than 1.5 Ω-cm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for at least the purpose of increasing the effectiveness of the current blocking layer.

In regards to claim 15, a further difference between Hirata and the claimed invention is the first current blocking having a thickness not less than 0.5 μm. Johnston discloses a current blocking layer 20 between 1 and 4 μm thick (see column 6, lines 34-40). In view of such

teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata to increase the thickness of the current blocking layer to a value greater than 0.5 μm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the effectiveness of the current blocking layer.

In regards to claim 16, a further difference between Hirata and the claimed invention is the first current blocking having a thickness not less than 1.0 μm. Johnston discloses a current blocking layer 20 between 1 and 4 μm thick (see column 6, lines 34-40). In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata to increase the thickness of the current blocking layer to a value greater than 1.0 μm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the effectiveness of the current blocking layer.

13. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Okazaki as applied to claim 10 above, and further in view of Adachi.

A further difference between Hirata and the claimed invention is a second current blocking layer formed on said first current blocking layer and composed of a nitride based semiconductor of a second conductivity type opposite to said first conductivity type. Figure 3 of Adachi et al. discloses a p-type cladding layer 5, a first current blocking layer 7, and an n-type second current blocking layer 8. In view of such teaching, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by

forming a second current blocking layer of a second conductivity type on the first current blocking layer. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of lowering the light confining effect while maintaining the carrier confining effect (see column 12, lines 50-55).

14. Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirata in view of Okazaki as applied to claim 10 above, and further in view of Hiroyama et al.

In regards to claim 17, a further difference between Hirata and the claimed invention is the flat portion of the cladding layer having a thickness not more than 0.3 μm. Figure 1 of Hiroyama et al. discloses a cladding layer 7 with a flat portion 7a and a ridge portion 7b, whereby the thickness t of flat portion 7a is selected to be not greater 0.08 μm (see column 10, lines 22-27). In view of such teachings, it would have been obvious to the ordinary artisan at the time the invention was made to further modify the invention of Hirata by decreasing the thickness of the flat portion to a value not more than 0.3 μm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the real refractive index difference of the active layer between the region under the ridge portion and the region under the flat portion.

In regards to claim 18, a further difference between Hirata and the claimed invention is the flat portion of the cladding layer having a thickness not more than 0.08 μm. Figure 1 of Hiroyama et al. discloses a cladding layer 7 with a flat portion 7a and a ridge portion 7b, whereby the thickness t of flat portion 7a is selected to be not greater 0.08 μm (see column 10, lines 22-27). In view of such teachings, it would have been obvious to the ordinary artisan at

the time the invention was made to further modify the invention of Hirata by decreasing the thickness of the flat portion to a value not more than 0.08 μm. The ordinary artisan would have been motivated to modify Hirata in the manner described above for the purpose of increasing the real refractive index difference of the active layer between the region under the ridge portion and the region under the flat portion.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Hata discloses a light-emitting device comprising nitride based active, cladding, and current blocking layers, with said cladding layer having a flat portion and a ridge portion.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew C. Landau whose telephone number is (703) 305-4396.

The examiner can normally be reached on 8:00 AM-4: 30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

EDDIE LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800

Matthew C. Landau
Examiner
May 29, 2002

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